M.2 – UPS

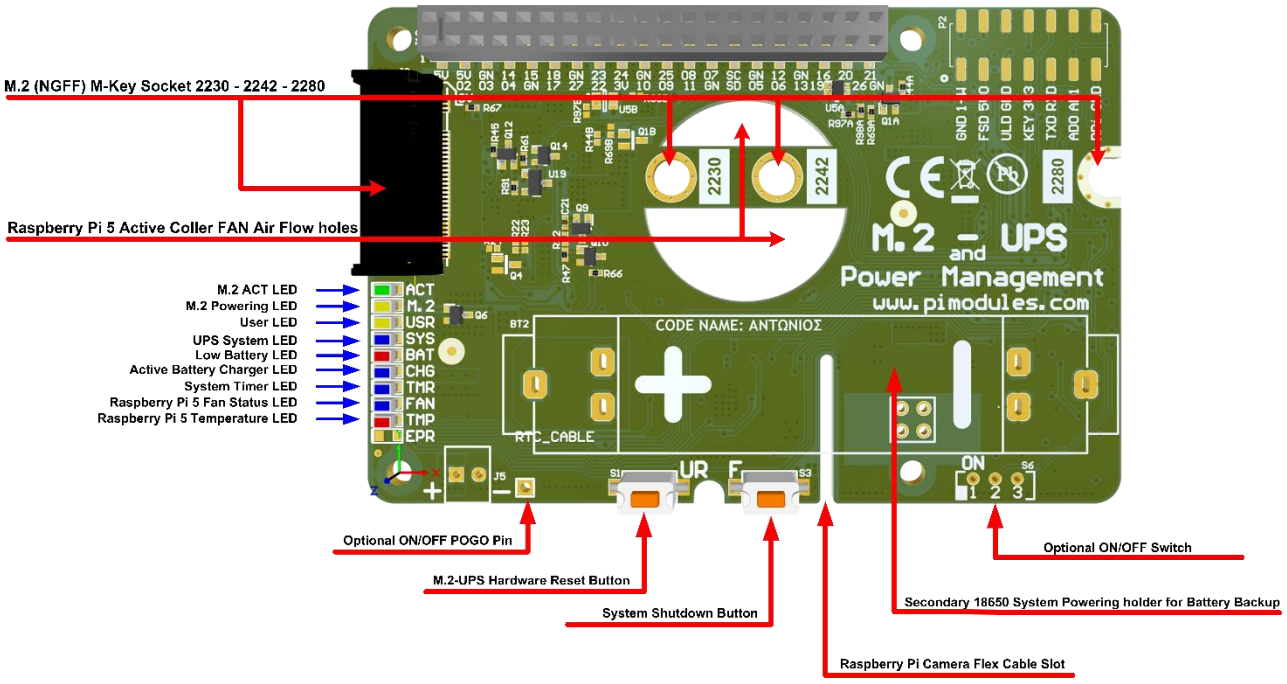
and

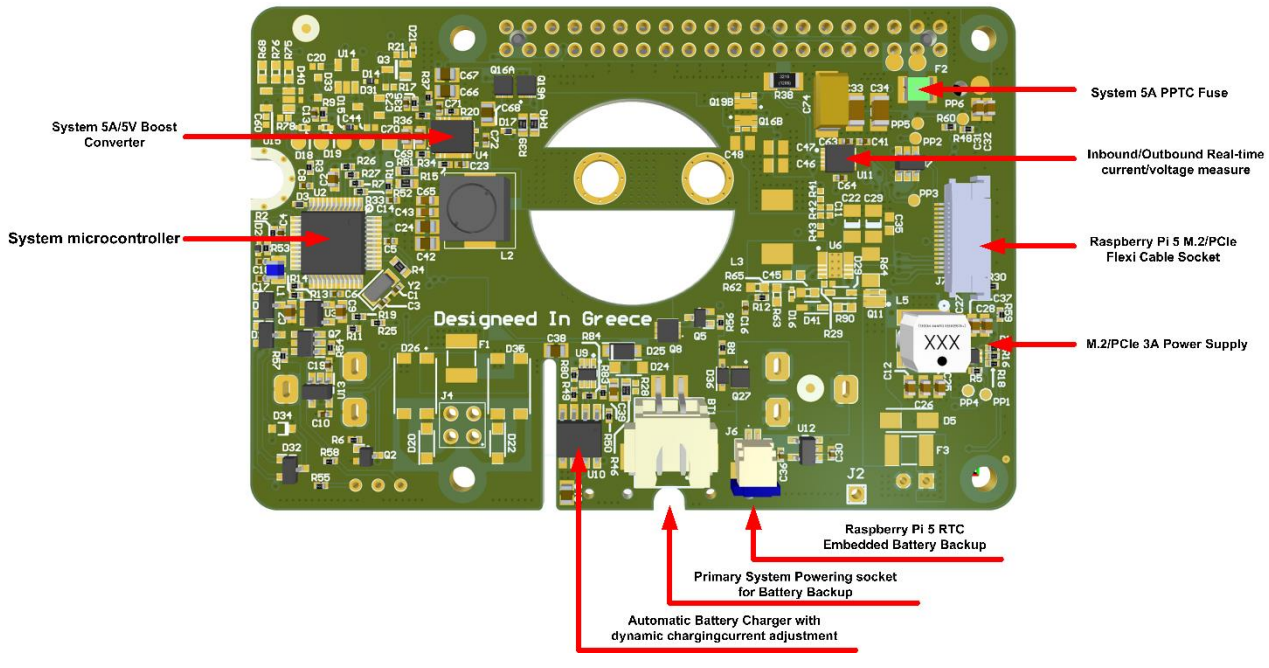
Power Management HAT for Raspberry Pi 5

Version Standard

The M.2 Ultimate Power Management System with RTC, Enhanced Peripherals and I²C control Interface

Intelligent Mobile Power Bank Ultra - High Current Extended Buck Supply of 5.0A





The **M.2 – UPS & Power Management HAT** is an Ultimate Power Management System HAT designed especially for **Raspberry Pi® 5** that open the full functionality of their embedded PCIe (M.2) interface and adds a wealth of innovative powerful and development features to the **Raspberry Pi® 5** microcomputer!

It has been designed especially for the **Raspberry Pi® 5** and considers all enhanced power and cooling requirements of the **Raspberry Pi® 5** models. It has been designed to work with **Official Cooler** exploring their enhanced cooling capabilities for **Raspberry Pi** as also for the added **M.2** devices.

The core functionality of the **M.2 – UPS & Power Management HAT** is to provide an interface for **M.2(NGFF) M-Key** (**2230, 2242 and 2280**) and at the same time protect and automatically shut-down your **Raspberry Pi® 5** if there is a cable power failure and can be set to automatically monitor and reboot your Pi once cable power has been restored!

However, it is only a small part of plenty and powerful functionalities that are implemented on this small HAT. The new **M.2 – UPS & Power Management HAT** contains two selectable backup power sources that can be used (once at a time). The wide available on the market Battery 18650 Li-Ion or large selection line of **XH-2.5** connector (600 mAh – 10 000 mAh) cover any extended Battery Backup request.

The new **M.2 – UPS & Power Management HAT** is the only one that supplies the **Raspberry Pi® 5 RTC** with battery backup (J5) and eliminates the need to use an additional battery for this purpose.

Last but not least is that implemented M.2 interface is equipped with **32786 kHz clock**, similar to the official **Raspberry Pi® 5** M.2 HAT.

The new **M.2 – UPS & Power Management HAT** does not need any additional powering cable and thanks to the implemented proprietary monitoring algorithm monitors the and current consumption via GPIO.

System Specifications

General

- **Dimensions: 85mm x 56mm**
- **Email broadcasting** on events (Cable Power loss/return, Wake-up, User Button, System Status)
- **Plug and Play**
- Ultra-light **System.d Daemon** based on threading
- **GPIO free** (all GPIOs are available for user application) **interaction with Raspberry Pi® via I²C**
- Enhanced System Monitoring and Programming API
- **Labeled J8 Raspberry Pi® GPIO Pins** for Easy Plug & Play of experimental cables
- Standard **THT 40 Pin** connector (not soldered)
- Remote bootloader for Live Firmware Update on remote locations
- Local bootloader for Live Firmware Update

Supported Battery Types and Capacities

- Supports a wide range of different Chemistry and capacities batteries and Super Capacitor (LiPO/LiFePO4/Li-Ion/ Super Capacitor 4000F)
- **Support for Li-Ion 18650 low-cost batteries** (from Electronic Cigarettes) with **dedicated holder on top**
- **Support for LiPO 18650 batteries** with **dedicated holder on top**
- **Support for LiFePO4 18650** with **dedicated holder on top**

User/Programmer Interface

- **I²C PIco API Interface** for Control and Monitoring, with over 50 programming registers
- Support for **4 different** users selectable I²C addresses sets:
  - **DEFAULT:** 0x68, 0x69, 0x6A, 0x6B, 0x6C, 0x6D, 0x6E, 0x6F
  - **NO_RTC:** 0x69, 0x6B
  - **ALTERNATE1:** 0x58, 0x59, 0x5A, 0x5B, 0x5C, 0x5D, 0x5E, 0x5F
  - **ALTERNATE2:** 0x48, 0x49, 0x4A, 0x4B, 0x4C, 0x4D, 0x4E, 0x4F

Embedded Peripherals and Interfaces

- **1 User Programmable button** (externally accessed)
- **1 User Programmable LEDs** (with mapping capability of the system behavior LEDs)
- **System File Safe Shutdown/Start-up button** with additional cable connectivity to external button (similar/alternative to **Raspberry Pi® 5** but with **ultra-low** current consumption)
- Integrated **Hardware Real Time Clock (RTC)** with Battery Back-Up in addition and independent (synchronized) to **Raspberry Pi® 5 RTC**
- **Dedicated Cable** for the **Raspberry Pi® 5 RTC** battery Supply

RTC Support and System Scheduler

- **RTC** Scheduler
- **Enhanced shutdown and start-up** system based on various internal/external events: Time stamp, Cable Powering/Loss (UPS), Battery Level, etc.

PCB Construction

- **2 oz copper** PCB manufactured for proper high current supply and cooling
- 6 mils track/6 mils gap technology **4 layers PCB**
- PCB Surface Finishing – Immersion Gold
- **Multi-layer Copper Thermal Pipes** for increased System Thermal Response and better passive cooling

M.2 (NGFF) M-Key Interface

- Supports **2230**, **2242** and **2280**
- Implemented **SUSCLK 32.768 kHz**
- Independent 3A Power Supply with Battery Backup
- Connectivity with **Raspberry Pi® 5** via **16 pins FPC**

Powering Options

- Protected (ESD, over current (PPTC fuse), **5A Supply @5V**
- **2 selectable power back-up** sources: **18650 Battery** or **XH-2P socket cable Battery**
- Enhanced **Line Interactive UPS** functionality (25us response time) powered via **Raspberry Pi® 5 5V GPIO**
- **Automatic Advanced Proprietary Power Spikes Tracking Algorithm**
- **Additional/Alternative to Raspberry Pi® 5 File Safe Shutdown** and **Start-up** Functionality on a Single Button
- **Continuously 5.0A@5.25V** supply on battery power backup
- **Intelligent Mobile Power Bank** functionality with safe shutdown/start-up, with Internal or External Slide Switch and RTC
- **Backup Supply Source (via additional Cable to J5) to Raspberry Pi® 5 RTC**

System Monitoring

- **Status Monitoring** – Powering Mode, Inbound current, Outbound current, Powering Voltage, Battery Voltage, Temperature (**Raspberry Pi® 5** Core **and M.2 – UPS & Power Management HAT**), Timer State
- **Events Pi** Log feature
- **System LEDs** – **ACT**, **M.2**, **USR**, **SYS**, **BAT**, **CHG**, **TMR**, **FAN**, **TMP** (optionally selected can be mapped to User LEDs)
- **System Healthy**, that informs user remotely if **Raspberry Pi® 5** Core **and M.2 – UPS & Power Management HAT** are running properly, and system is power protected (based on various internal system triggers)

System Protection

- Optional Direct **Raspberry Pi® 5 Button** via Spring Loaded Pogo Pinpoint to **J2**
- **Programmable Watch-Dog Hardware** feature (**St**ill **A**live Timer)
- **PPTC 5A@5V fuse**
- **ZVD circuit** on all 5V GPIO connections
- **Micro-controller**-based **watchdog**
- Over-Temperature protection
- Over-Current protection

Embedded Sensors

- **Inbound/Outbound High-side bi-directional hardware current/voltage sensing monitor** with power calculation on 5V supply
- **onboard** Voltage sensors:
  - Battery Voltage Level
  - Raspberry Pi GPIO 5V level Voltage
- **onboard** additional Temperature Sensor

Case Compatibility

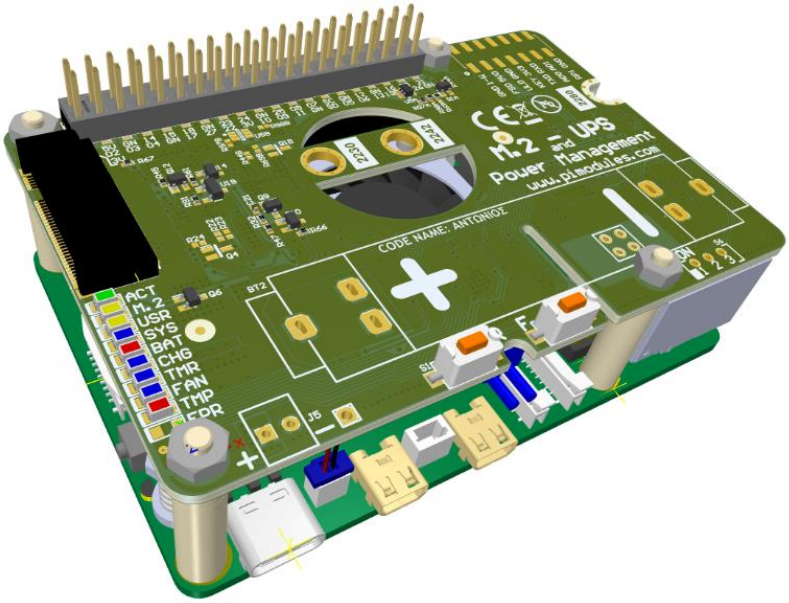
- Dedicated Case Coming soon

System Design

- Designed and Simulated with PDA Analyzer with one of the most advanced CAD/CAM Tools – Altium Designer
- Design Based on Microchip 16-bit 16 MIPS micro controller
- Industrial Originated

System Indicators

- **M.2 ACT LED**
- **M.2 Powering LED**
- **User LED**
- **UPS System LED**
- **Low Battery LED**
- **Active Battery Charger LED**
- **System Timer LED**
- **Raspberry Pi 5 Fan Status LED**
- **Raspberry Pi 5 Temperature LED**


M.2 and UPS
Power Management
www.pimodules.com
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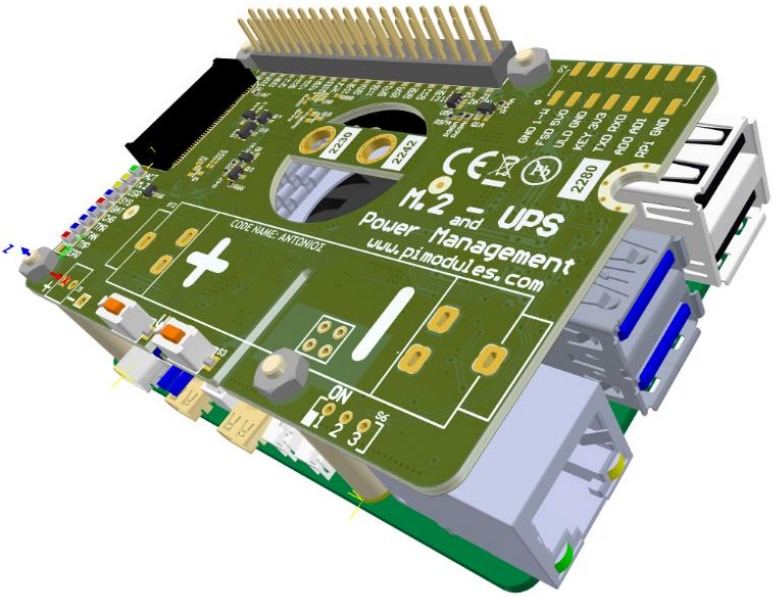
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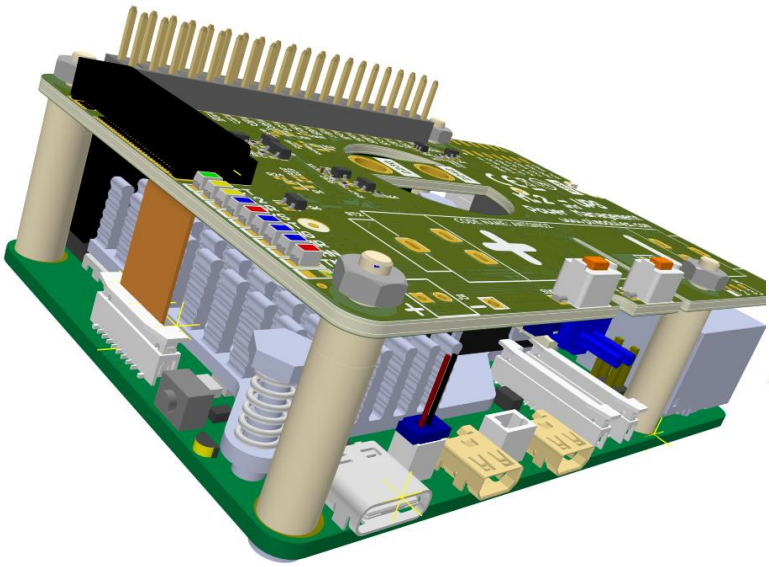

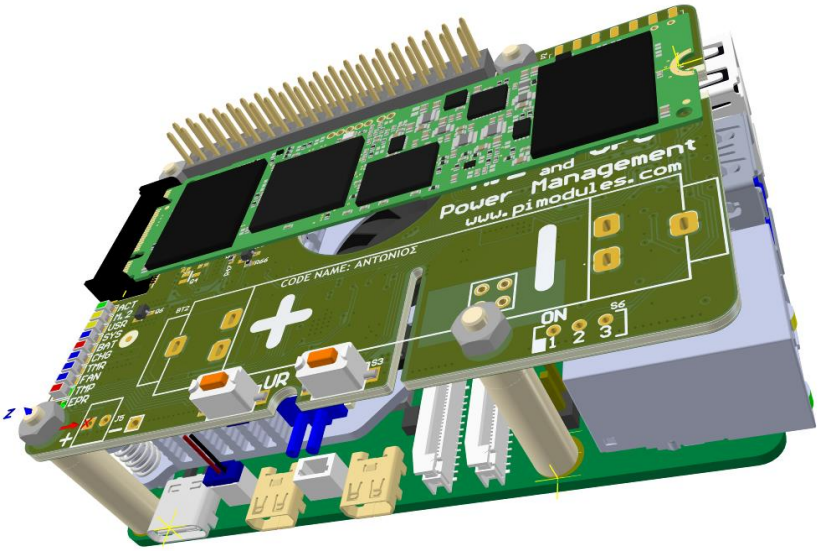
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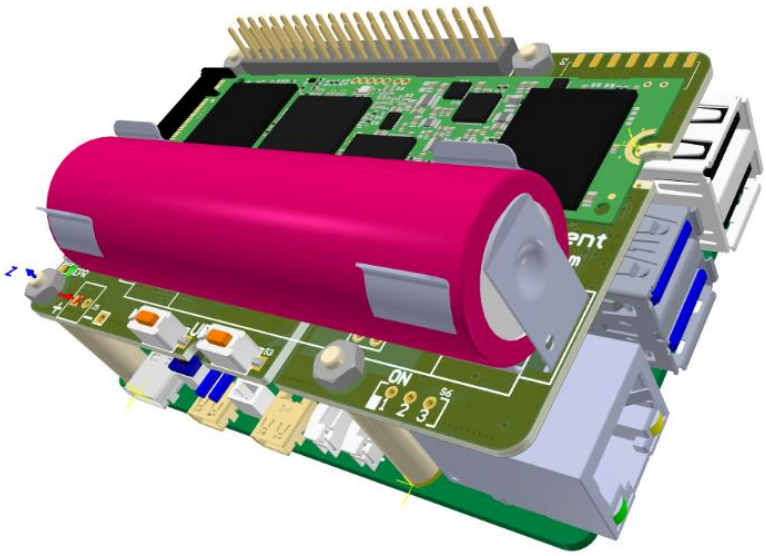

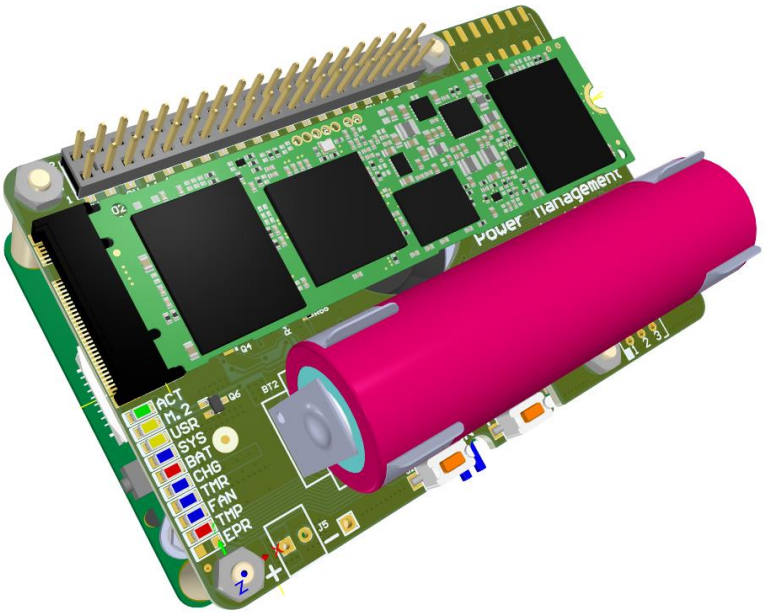
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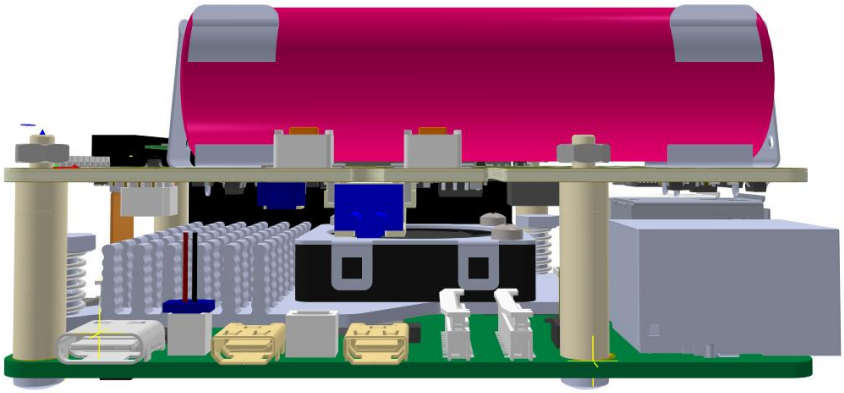

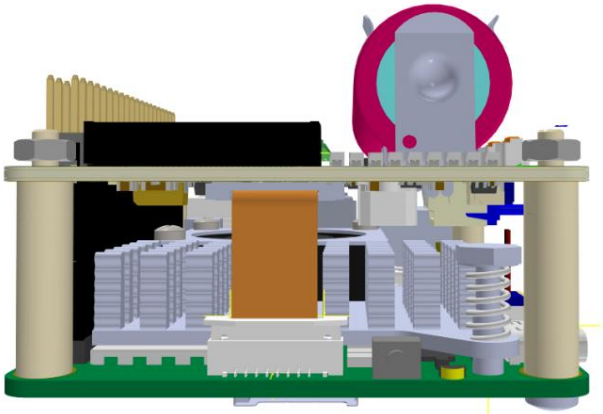

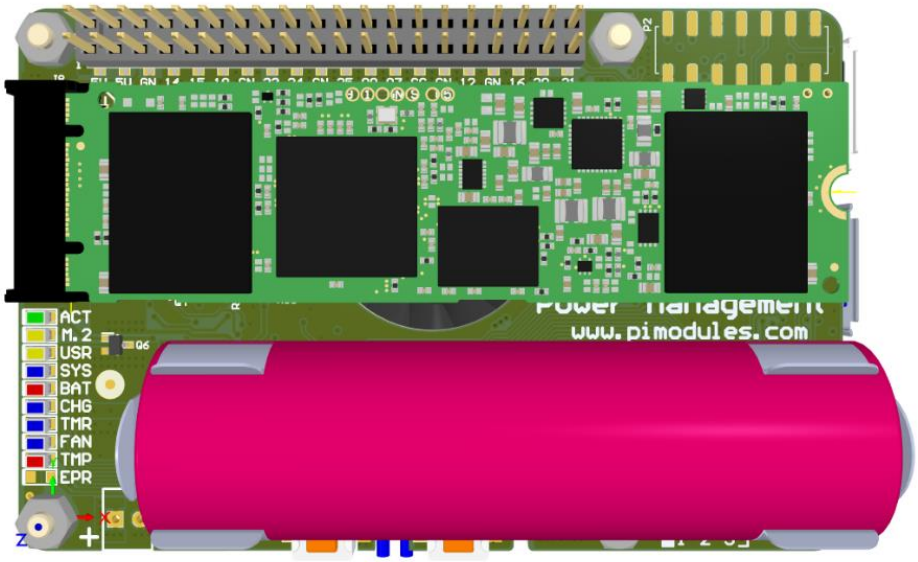
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